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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/982,953	10/22/2001	Allen McTeer	M4065.0247/P247-A	8778
24998	7590	01/26/2006	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			GEYER, SCOTT B	
2101 L Street, NW			ART UNIT	
Washington, DC 20037			PAPER NUMBER	
			2812	

DATE MAILED: 01/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.		Applicant(s)	
	09/982,953		MCTEER, ALLEN	
	Examiner		Art Unit	
	Scott Geyer		2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 22-35,58 and 60-62 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22,23,26-35,58 and 61 is/are rejected.
- 7) ☒ Claim(s) 24,25,60 and 62 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 29-35 and 61 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 29 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: a heat-radiating layer of aluminum nitride is formed "completely" on an upper surface of a first conductive plug; a second conductive plug is formed on the heat-radiating layer and is in electrical contact with the first plug. If the heat-radiating layer, which is claimed to be aluminum nitride (a ceramic, which is not electrically conductive) is completely formed over the first plug, then it is blocking the second plug from being in physical contact with the first plug, which therefore blocks the two plugs from being in electrical contact. If the two plugs are indeed meant to be in electrical contact, then the applicant should further define how the two are connected since the aluminum nitride layer is in between the two plugs. Claims 30-35 and 61 are also rejected since they depend from claim 29 and therefore contain all of the limitations of claim 29. The claims will not be treated further on their merits.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 22, 23, 26, 28 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arunachalam et al. (6,139,696) in view of Numata (5,476,817).

As to **claims 22 and 58**, Arunachalam et al. teach a method of forming a copper interconnect as shown in figures 9-13. A first contact opening is formed in insulating layer 906 over a semiconductor substrate 901. A conductive plug 907 is formed in the contact opening and the conductive plug is in contact with the insulating layer. A second insulating layer 909/911/913 is formed over the plug and the first insulating layer. An opening 917 is formed in the insulating layer 909/911/913 and a barrier layer 1002/1102 is formed in the opening. A copper conductor 1202 is formed over the barrier layer 1002/1102. A layer 1302 is formed completely over the upper surface of the copper conductor. Arunachalam et al. do not teach that the layer is an aluminum nitride layer. However, Numata teaches aluminum nitride layers 22 formed completely over metal conductive contacts, as shown for example in figure 2D. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the method of Arunachalam et al. with an aluminum nitride layer as taught by Numata so as to assist in diffusing heat from the metal leads (column 6, lines 29-36).

As to **claim 23**, Arunachalam et al. teach planarization of the copper layer and the barrier layer (see col. 8).

As to **claim 26**, Numata teaches a deposition process for the aluminum nitride (see col. 6).

As to **claim 28**, Arunachalam et al. teach the barrier layer 1002 to be a refractory metal nitride (see col. 7).

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Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Arunachalam et al. (6,139,696) and Numata (5,476,817) as applied to claim 22 above, and further in view of examiner's official notice.

As to **claim 27**, Numata is cited as noted above for teaching the deposition and use of aluminum nitride. Numata does not specifically teach the process of sputtering to deposit aluminum nitride. However, it is notoriously well known in the art of semiconductor manufacturing to use sputtering to deposit aluminum nitride, and it would have been obvious to one of ordinary skill in the art to modify the method of Arunachalam et al. and Numata with sputtering to provide a layer of aluminum nitride.

Allowable Subject Matter

Claims 24, 25, 60 and 62 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

The following reference is cited as being particularly related to the applicant's disclosure: Mu et al. (5,612,254).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott Geyer whose telephone number is (571) 272-1958. The examiner can normally be reached on weekdays, between 10:00am - 6:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Handwritten signature of Scott Geyer and the date 1/21/06.

Scott Geyer
January 21, 2006